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REQUIREMENTS ELICITATION OF PASSENGERS WITH REDUCED MOBILITY FOR THE DESIGN OF HIGH QUALITY, ACCESSIBLE AND INCLUSIVE PUBLIC TRANSPORT SERVICES

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Abstract
In this article the authors present the methodology adopted and the results obtained in the first stage of the research encompassing focus group interviews (FGI) about the needs of public transport users in a selected city (Poznan). The elicitation and assessment of the requirements were carried out for three groups of people with disabilities using public transport in the city of Poznań: blind and partially sighted people, deaf and hearing-impaired people, as well as people with locomotor dysfunctions. A study carried out on the basis of a scenario especially designed for the FGI purpose has made it possible to identify barriers for people with disabilities and, consequently, to formulate their pre-trip,on-trip and post-trip requirements when it comes to urban public transport services. The results will be used to construct a questionnaire to be used further on in the project.

Keywords
requirements management, service quality, sustainable transport, public transport planning.

Introduction

Among the many, intertwined modern concepts of organisation management the concept of quality management still dominates, with the customer being the major focus of any organisation [1]. The work on the quality of a product/service throughout its life cycle begins with the identification of customer/user requirements [2, 3]. The identification of requirements conditions the appropriate design of the product/service, and the extent to which the requirements are met is the basis for improving the functioning of the organisation [4]. It is significant that along with the technical progress (identified today mainly with the development of new technologies, including IT) and with the increasing awareness of customers/users, the requirements are constantly changing. By defining the needs precisely we may avoid losses (organizational, financial, etc.) due to improvements of the products or services (or rather of their features), which the customers do not need or which are of secondary importance to them.

This article focuses on the services of urban public transport services. Public transport includes services that are available to everyone, whether travelling individually or collectively, based on published fares, and publicly advertised. Its timetables and schedules are fixed, with permanent routes and stops (or specific points of departure and destination/area of operation) [5].

Public transport operators should provide a transportation service that meets the customers needs by delivering a high quality of the services. Futhermore the society itself demands sustainability and accessibility. The idea of sustainable transport involves solutions that are effective, friendly to the society, economically efficient [6, 7] with minimized environmental impact, and which meet the needs of the present without compromising the ability of future generations to meet their own needs. The idea is implemented today by developing solutions which make the public transport widely accessible.

Accessibility is understood as the possibility to use the public transport by anyone interested [8]. In the social dimension, this means creating conditions for sustainable mobility for the society as a whole, taking into account the needs of all social groups. Such solutions may be developed only after the needs of all potential users of the system, including persons with reduced mobility, have been recognized and taken into account. The next part of the article presents an overview of research results in this area.

Literature survey

The problem of adjusting the features of public transport systems to the requirements of all customer groups can be found both in theory (the literature) and in practice (e.g. when new vehicles or organisational solutions are designed). The rationale for choosing this topic as research area lies in the influence of free mobility in the urban space on the quality of life [9]. This becomes particularly important for people with reduced mobility, whose mobility-related difficulties may prevent them from working, using medical services as well as participating in cultural and social life. The issue is consistent with the European Union strategy, which calls for the respect for the rights of people with reduced mobility to benefit from measures designed to ensure their independence, social and professional integration, and participation in community life [10]. This translates into legislation in the member states of the European Union. For example, in 2010 the Polish Parliament passed a law on public transport, setting out a plan for its sustainable development taking into account the needs of people with disabilities and persons with reduced mobility. Unfortunately, the needs of the disabled and people with reduced mobility were not specified; the sources defining such needs were not indicated, either [11].

The results of research presented in the literature concerning the needs of passengers with disabilities most often refer to:

- general studies of the problem [12],
- a selected system or elements of a public transport system, e.g. Indian Railways [13], railway station in Valjevo-Loznica [14],
- a specific group of passengers, e.g. sight and hearing impaired [9],
- IT solutions used to support passengers travelling by public transport, e.g. travel assistant application based on Bluetooth and Android technologies [15, 16]. The application has been designed for tourists and passengers unfamiliar with the given transport system, and for people with specific requirements related to their disability [17].

The majority of publications include opinions about the evaluated transport system [18] or information on suggested solutions and improvements related to the development of the public transport system [10], disregarding the stage of preparation and conducting studies aimed at gathering information about passenger requirements.

Methodology

The main aim of the research was to identify the needs of people with reduced mobility (PRM) regarding the public transport. Three milestones were defined to achieve the objective. The first one was to identify (diagnose) the needs of people with reduced mobility (PRM) regarding public transport, the second one was to analyze the critical needs, and the third one was to evaluate the needs of PRM regarding urban public transport.

The three objectives were planned to be achieved in three stages of the study (Fig. 1).

In the first stage, three focus group interviews (FGI) were to be conducted. The interviews were designed to involve the customers of the service, taking into account the type of disability. Three types of disability were distinguished:

- locomotor dysfunctions,
- sight dysfunctions (blind/partially sighted persons),
- hearing dysfunctions (deaf/hearing impaired persons).

In the next part of the study the list prepared during the interviews will be verified by experts through individual interviews. Four experts are planned to take part. The roles of the experts are: verification of the list and checking the correctness of wording in the questionnaire. As a result of the meetings, the needs of people with reduced mobility will be organized and categorized to serve as the basis for developing a tool – a survey, in the final part of the study. The third part of the study, a survey,

will be conducted on a sample of 430 respondents, selected by quota sampling.

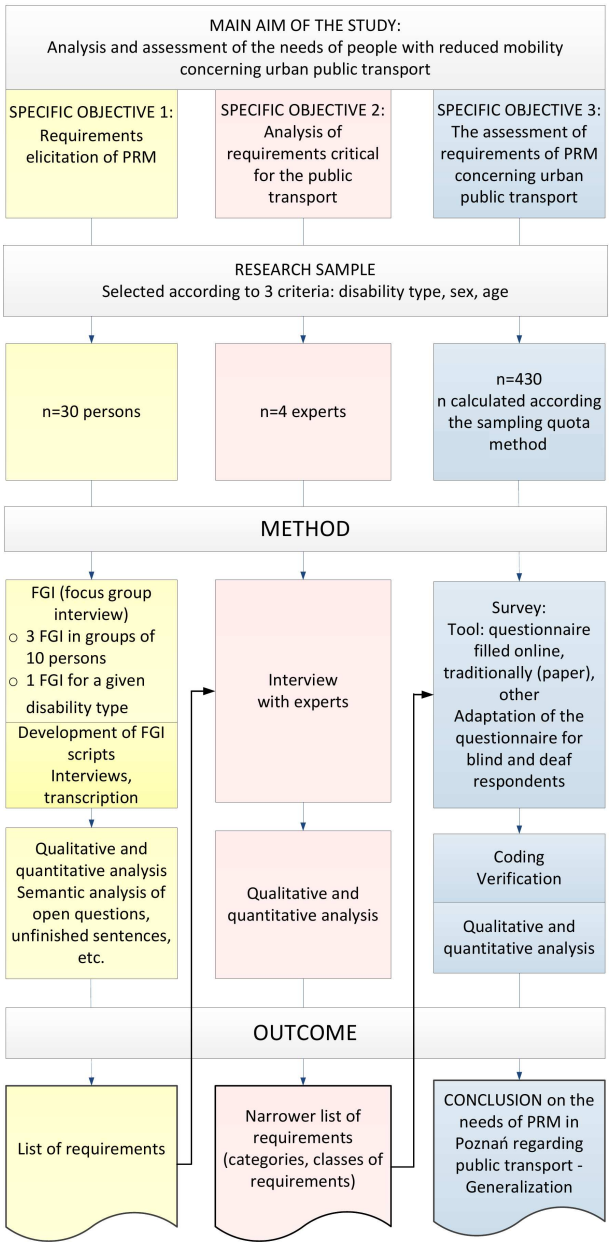

Fig. 1. Methodology used in the study.

FGI survey

FGI design

Focused group interviews were conducted through three separate meetings chaired by a moderator.

A script was developed for the purpose of the focus group interviews. First, it involved the identification of travel barriers faced by people with reduced mobility using public transport in Poznań.

The identification of travel barriers and ranking them by importance became the basis for a pilot study recognizing the needs of people with reduced mobility related to their journeys, taking into account the expectations of each group of respondents. The term "journey process" was used in the study, meaning and consisting of the following three main stages:

- the first, pre-trip, refers to actions and feelings related to and taking place when planning the journey;
- the second, on-trip, refers to the course of travel and everything related;
- the third, post-trip, refers to actions and feelings of the passenger after reaching the destination.

To facilitate the analysis of all journey aspects to respondents, some of them were pre-defined:

A. pre-trip activities

- Getting to the bus/tram stop.
- Buying a ticket (ticket purchase possibilities).
- Trip planning tools (e.g. website of ZTM – Urban Transport Authority, application jakdojade.pl, timetable at the bus/tram stop).

B. on-trip activities

- Waiting on the bus/tram stop (infrastructure).
- Information available at the bus/tram stop.
- Boarding the bus/tram (retractable ramps, driver assistance).
- Travelling.
- Information in the vehicle.
- Alighting a bus/tram (e.g. the possibility to signal longer exit time).
- Transfers – associated with moving through city transport hubs (e.g. guiding signs).

C. post-trip activities

- Leaving the bus/tram stop.
- Opportunity to express one's opinion on the service quality.

Each interviewee was asked to remember a situation when he/she used the public transport system. Then he/she was asked to propose the lacking stages of the journey. In this way, the general description of a journey taken with public transport was completed with aspects, which – when not met – cause unnecessary complications in the travel of a person with reduced mobility. All the statements of the respondents were noted down on a flipchart (in the wording used by the interviewees), and the entire interview was documented using video recording.

At the end of the proper interview stage, the importance of travel aspects mentioned by the respondents was determined (joint assessment for each as-

pect). The following rating was applied: 1 – completely irrelevant; 2 – rather irrelevant; 3 – neither important nor unimportant; 4 – rather important; 5 – very important. The results were written down on the flipchart.

FGI results – part I (LD persons)

The results obtained in the group of persons with a locomotor dysfunction (LD) are as follows:

A. pre-trip

- *planning the route according to bus/tram stop accessibility (required signage to designate stops accessible for persons with LD)*,
- no standardization of stops (different kerb height, different distance from the ground to vehicle floor),
- portable, lightweight ramp in trams and buses for manual assembly,
- *the need for updated information about schedule and route changes, taking into account the information for people with LD*,
- the height of the ticket puncher,
- getting to the bus/tram stop (ramp maintenance, snow removal, kerbs, gutters; suggestion to replace them e.g. with tactile paving, etc.).

B. on-trip (bus/tram stop)

- stop zone signage with information about entrance for persons with LD (e.g. zone B for persons with LD, equipped with raised kerbs facilitating entry to the vehicle),
- low awareness and empathy of drivers and operators,
- the lack of retractable ramps in trams,
- *timetables on bus/tram stops placed too high and written in too small letters*,
- electronic information on the vehicle seen only when the wheelchair is located contrary to the recommendations,
- too few places for wheelchairs in vehicles (1 per vehicle),
- security belts are not used (too difficult to fasten and unfasten),
- the wheelchair should face the direction of travel,
- the lack of low-floor trams at night.

B. on-trip (on the vehicle)

- *more information displays*,
- *voice information ("next stop...")*,
- LD-accessibility icons should be added to route plans,
- *information about failures*,
- *information about vehicle changes*,
- information about out-of-service elevators and ramp repairs,
- signalling the intention of alighting (more buttons in the zone for persons with LD),
- *information about potential transfers at a given stop (how many minutes to next bus/tram accessible for person with LD).*

C. post-trip

- leaving the stop safely (e.g. sound or voice warning passengers who embark the vehicle that a person with LD is alighting),
- last bus/tram in the timetable accessible for persons with LD,
- *evaluation of driver/operator*,
- *assessment of vehicle accessibility.*

FGI results – part II (SD persons)

The results obtained in the group of persons with sight dysfunction (SD) are as follows:

A. pre-trip

- *planning the route taking into account website or mobile app transparency (simple message without unnecessary text)*,
- no standardization of stops (different kerb height, information for persons with SD in different places or their lack),
- *mobile information on approaching vehicle*,
- *the need for updated information about schedule and route changes, taking into account the information for people with SD*,
- *development of mobile voice application*,
- getting to the bus/tram stop (ramp maintenance, snow removal, kerbs, gutters; suggestion to replace them e.g. with tactile paving, etc.).

B. on-trip (bus/tram stop)

- stop zone signage with information about entrance for persons with SD,
- low awareness and empathy of drivers and operators,
- lack of visible numbers on vehicles: increase their quantity to make them more visible from any side,
- *timetables on bus/tram stops placed too high and written in too small letters*,
- information displayed electronically should be spoken,
- on a double stop, one does not know what second tram or bus approaches,
- no maps for persons with SD,
- spoken messages about approaching tram,
- "talking" timetable – in a standardized location.

B. on-trip (on the vehicle)

- external button to open the door – person with SD cannot see it,
- *voice information: "current stop" and "next stop..."*,

- icons about accessibility for persons with SD should be added to route plans,
- *information about vehicle failures and necessity to leave the vehicle*,
- *information which vehicle I boarded*,
- drivers and operators do not react to persons with a white cane,
- signaling the intention of alighting (more buttons in the zone for persons with SD, with the option to connect/talk to the driver),
- *information about potential transfers at a given stop (how many minutes to next bus/tram)*,
- no standardized location of seats for persons with SD and door opening buttons.

C. post-trip

- *expressing one's opinion about the journey - by way of emoticon signs (ϑ)*,
- *expressing opinion about driver/operator (doubtful - maybe on the phone).*

FGI results – part III (HD persons)

The results obtained in the group of persons with hearing dysfunction (HD) are as follows:

A. pre-trip

- *planning the route taking into account website or mobile app transparency (simple message without unnecessary text)*,
- *well developed mobile app based on symbols*,
- *simple shape of website (symbols and graphical elements)*,
- the need for updated information about schedule and route changes (information about changes, vehicle failures and repairs),
- developing standards for information about public transport,
- no standards at traffic lights (light induction, only sound – image should be added).

B. on-trip (bus/tram stop)

- kerb height vs. tram height,
- too much text, information available in leaflets and applications,
- lack of visible numbers on vehicles: increase their quantity to make them more visible from any side,
- timetables on bus/tram stops placed too high and written in too small letters,
- light signal about approaching vehicle,
- *phone vibration informing about approaching vehicle*,
- *information about vehicle failure on phone display and in mobile app.*

B. on-trip (on the vehicle)

- more information displays in the vehicle,
- *displayed information: "current stop" and "next stop..."*,
- *icons about accessibility for persons with HD should be added to route plans*,
- *information about vehicle failures and necessity to leave the vehicle*,
- *contact with operator*,
- area for the disabled,
- duplicate names of stops – misleading (e.g. Rondo Rataje),
- *information about potential transfers at a given stop (how many minutes to next bus/tram)*,
- location of seating (lateral – bad idea).

C. post-trip

- *expressing one's opinion about the journey – by way of emoticon signs (ϑ)*,
- *expressing opinion about driver/operator (not necessary – maybe using hotline).*

The interviewees pointed out mainly their unfulfilled needs, sometimes they proposed ways (either technical or organizational) to improve their satisfaction. Even a brief analysis of the identified requirements shows a lack of standardized solutions. Moreover, the requirements mentioned by interviewees were similar, although they should be implemented in a manner adjusted to the specific group of respondents; it is therefore necessary to design universal solutions, adjusted to the needs of all public transport users (not only people with disabilities). Another important conclusion is that the lack of appropriate technical solutions (e.g. infrastructure) and organizational shortcomings in the public transport system may be successfully overcome by a passenger information system, also in the form of a mobile application, as suggested by the respondents (phrases in italics). The respondents used the available rating scale. For example, in the group of persons with LD, the requirement "panning the route according to bus/tram stop accessibility (required signage to designate stops accessible for persons with LD)" was assigned the rating "5", while the "the height of the ticket puncher" was rated "2".

The final point of the FGI was to collect the opinions of respondents (the group of persons with LD) about their satisfaction with the selected aspects of public transport in Poznań. The respondents used a scale of 1 to 5 (1 – very bad, 2 – rather bad, 3 – neither good nor bad, 4 – rather good, 5 – very good) to indicate their level of satisfaction with various aspects of public transport in Poznań. The survey included questions about:

- trip planning tools (e.g. website of ZTM – Urban Transport Authority, application jakdojade.pl, timetable at the bus/tram stop),

- buying a ticket (ticket purchase possibilities, if needed),
- getting to the stop (e.g. crossing the street, access to the bus/tram stop),
- waiting on the bus/tram stop (stop infrastructure),
- information available at the bus/tram stop,
- boarding the bus/tram (retractable ramps, driver assistance),
- journey (comfort, safety),
- information in the vehicle,
- alighting a bus/tram (e.g. the possibility to signal longer exit time),
- transfers – associated with moving through city transport hubs (e.g. guiding signs),
- leaving the bus/tram stop,
- opportunity to express one's opinion on the service quality.

Focus group interview with a group of persons with movement disabilities was finished by examining the satisfaction level of the trip process. The main objective of this pilot examination was checking the understanding of the term 'evaluate the satisfaction level with given feature'. The results acquired showed that: Firstly, they understood the order and did evaluation. Secondly, the evaluations were different, what gives the conclusion that they were thought. Thirdly, it was noticed that group evaluation and individual evaluation of satisfaction level were differing from each other, and that means that subjects understand semantic differences between significance evaluation and evaluation of satisfaction level (Fig. 2).

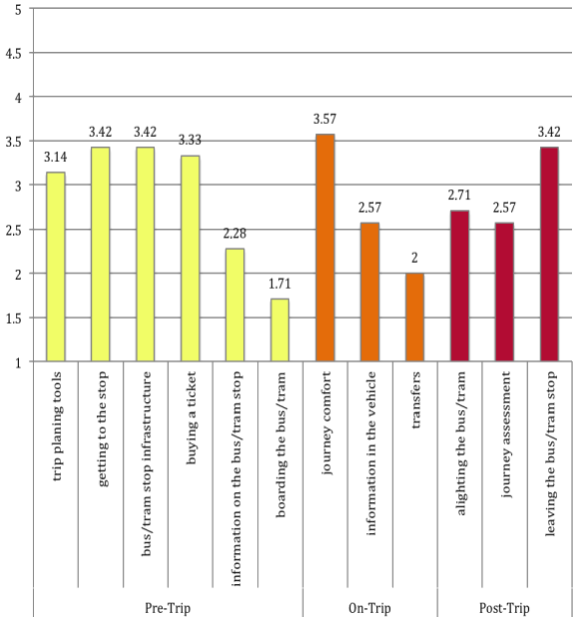

Fig. 2. Satisfaction with the selected aspects of public transport in Poznań (in the group of persons with LD).

The results of the survey on the satisfaction with the selected aspects of public transport in Poznań (in the group of persons with LD) will be used to develop a final set of questions in the questionnaire survey.

Further research

The results of the study will be used in the next part of the project (proper survey, aimed at identification of requirements of passengers with reduced mobility using public transport). The elicitation of requirements, as indicated in the title of this paper, is a crucial element in the design of high quality, accessible and inclusive public transport services.

The scope of the research in question relates to the objective of the project "Accessible and inclusive mobility for all with individual travel assistance" (aim4it), focusing on the design of solutions facilitating the use of an integrated, intermodal public transport system without limitations and barriers excluding passengers with special needs concerning their mobility in urban areas.

The project is carried out under the ENT-III Flagship Call 2013 Future Travelling initiative. The project leader is the Institute of Transportation Systems of the German Aerospace Center (Braunschweig, Germany).

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